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Optical conductivity of topological surface states with emergent supersymmetry[1] JOSEPH MACIEJKO, University of Alberta, WILLIAM WITCZAK-KREMPA, Harvard University — Topological states of electrons present new avenues to explore the rich phenomenology of corre- lated quantum matter. Topological insulators (TIs) in particular offer an experimental setting to study novel quantum critical points (QCPs) of massless Dirac fermions, which exist on the samples surface. Here, we obtain exact results for the zero- and finite-temperature optical conductivity at the semimetal-superconductor QCP for these topological surface states. This strongly interacting QCP is described by a scale invariant theory with emergent supersymmetry, which is a unique symmetry mixing bosons and fermions. We show that supersymmetry implies exact relations between the op- tical conductivity and two otherwise unrelated properties: the shear viscosity and the entanglement entropy. We discuss experimental considerations for the observation of these signatures in TIs.

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